WPS 2645

POLICY RESEARCH WORKING PAPER 2645

Inequality Convergence

Martin Ravallion

Is income inequality tending to fall in countries with high inequality and to rise in those where inequality is low? Is there a process of convergence toward medium-level inequality?

The World Bank
Development Research Group
Poverty
July 2001

Summary findings

Comparing changes in inequality with initial levels, using new data, Ravallion finds that within-country inequality in income or per capita consumption is converging toward medium levels—a Gini index around 40 percent. The finding is robust to allow for serially independent measurement error in inequality data and for short-run dynamics around longer-term trends.

However, the convergence process is neither rapid nor certain, and more observations over time are needed to be confident of the pattern. Ravallion offers an approach to modeling the determinants of inequality that may be a starting point for estimating richer models.

This paper—a product of Poverty, Development Research Group—is part of a larger effort in the group to better understand what is happening to income inequality within developing countries. Copies of the paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Patricia Sader, room MC3-556, telephone 202-473-3902, fax 202-522-1153, email address psader@worldbank.org. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. The author may be contacted at mravallion@worldbank.org. July 2001. (23 pages)

Inequality Convergence

Martin Ravallion[1]

World Bank, 1818 H Street NW, Washington DC 20433, USA

1 Addresses for correspondence mravallion@worldbank.org. This paper was written while the author was visiting the Université des Sciences Sociales, Toulouse. These are not necessarily the views of the World Bank or any affiliated organization. For their helpful comments on an earlier version of this paper, the author is grateful to Roland Bénabou, Francois Bourguignon, Shaohua Chen, Angus Deaton, Bill Easterly, Jyotsna Jalan, Stephen Jenkins, Aart Kraay, Branko Milanovic, Giovanna Prennushi, Dominique van de Walle and Michael Walton.

1. Introduction

Past tests of the empirical implications of the neoclassical growth model have largely focused on its implications for convergence in average incomes. However, the neoclassical model can also yield convergence of the whole distribution, not just its first moment; as Bénabou (1996, p.51) puts it:

> "Once augmented with idiosyncratic shocks, most versions of the neoclassical growth model imply convergence in distribution: countries with the same fundamentals should tend towards the same invariant distribution of wealth and pretax income."

The simplest test for inequality convergence borrows from growth empirics and looks at the correlation across countries between changes in measured inequality and its initial levels, analogous to standard tests for mean income convergence. This is the method used in what appears to be the first attempt to test for inequality convergence in the literature, namely by Bénabou (1996), who found evidence of convergence in various data sets.

This paper revisits Benabou's findings using new and better data sets. While the data used here appear to be the best compilations currently available for this purpose, the data are far from ideal. There are limitations in coverage across countries and over time. For example, in the 83 developing and transitional countries included in the Chen and Ravallion (2000) distributional data set, only 21 have four or more surveys over time. There are also serious concerns about measurement error in inequality data. There are the usual concerns about sampling and non-sampling errors in estimates from a single survey; consumption and (even more so) income underreporting is thought to be a common problem in surveys and its is unlikely to be distribution-neutral. There are also concerns about survey comparability over time, given that even seemingly modest changes in survey design (such as recall periods) and processing (such as valuation methods for income-in-kind) can change measured inequality.[2] These problems may well have considerable bearing on the results of convergence tests. Under (over) estimating the initial level of inequality would lead to over (under) estimation of the subsequent trend — a source of bias commonly known as "Galton's fallacy". The magnitude of the bias is unclear a priori. While there is only so much that can be done to address such concerns, the paper offers a test for convergence that is at least robust to serially independent measurement error in inequality data.

After reviewing the literature in the next section, the tests for inequality convergence are described in section 3. Section 4 implements the tests on two data sets. Signs of convergence toward medium levels of inequality are found for both the Gini index and various points on the Lorenz curve, and for samples with and without Eastern Europe and Central Asia. Convergence is less strong in the test allowing for measurement error, but it is still evident. The concluding section points to implications for current policy debates and for further research.

2. Antecedents in the literature

Tests for convergence in average incomes have been used to better understand the evolution of inequality <u>between</u> countries.[3] We know less about what has been happening to income inequality within countries. There have been numerous investigations of how inequality has been changed in specific countries and there have been compilations of estimates of inequality measures across countries and over time. Analysis of one such compilation produced by Deininger and Squire (1996) has been used to argue that very few countries outside Eastern Europe and Central Asia have experienced a significant trend increase or decrease in inequality

2 See for example Ravallion and Chen (1999) on the problems in measuring inequality in China.

3 On the theory and evidence on income convergence see Durlauf and Quah (1999).

over the last two decades or so (Bruno, Ravallion and Squire, 1997; Li Squire and Zou, 1998).[4] Thus Li et al. (1998, p.26) argued that "income inequality is relatively stable within countries". Dollar and Kraay's (2000) results also suggest approximate distribution-neutrality in the process of economic growth; on average growth-promoting policy reforms appear to be as good at (proportionately) raising the incomes of the poor as for anyone else.

These findings are suggestive of convergence; if inequality is in fact generated by a stationary process without trend than initial disparities between countries in their levels of inequality will persist, in expectation. However, that conclusion may be premature, given that none of the work summarized above has actually tested for inequality convergence. Limitations in data and methods cloud our current knowledge on this issue. The household surveys on which inequality is measured are far less frequent than the National Accounts. And they tend also to be unevenly spaced over time. Surveys tend also to be less standardized than National Accounts. So there are comparability problems between countries and over time, and measurement errors in existing data compilations.

Distinguishing trends from fluctuations is problematic with the available data. Yet conclusions are often drawn about inequality trends based on data compilations and statistical methods that ignore some or all of these problems. For example, trends are often tested using static regressions in which measured inequality is regressed on time (as in Bruno et al., 1997, and Li et al., 1998). This is an understandable simplification given the data available, but it is hazardous too. From time series econometrics we know how important it is to take proper account of the dynamic structure of any variable (such as whether it is positively or negatively

[4] The countries Eastern Europe and the former Soviet Union have experienced unusually sharp increases in inequality, starting from low levels (Milanovic, 1998).

serially dependent) when trying to detect a trend. If a variable is serially dependent then tests for a significant trend that ignore this fact can be deceptive (for discussion and references see Davidson and MacKinnon, 1993, Chapter 19). Li et al. (1998) appear to implicitly acknowledge the problem when they note that they do not allow for dynamics in testing for trends in inequality, because they have too few observations over time.[5]

Bénabou (1996) appears to have been the first paper to test for inequality convergence. He regressed the change in the Gini index between the first and last observation on the Gini index for the first observation. Bénabou finds evidence of significant negative coefficients on the initial inequality index in various data sets and time periods, though not all.[6] In addition to testing for convergence on a new data set, I will offer tests that are more robust to likely measurement error.

3. Testing for inequality convergence

Borrowing from the literature on testing for convergence in mean income, the simplest test for inequality convergence is to regress the observed changes over time in a measure of inequality on the measure's initial values across countries, analogous to standard tests for convergence in average incomes. This is the test for inequality convergence used by Bénabou (1996). Let G_{it} denote the observed Gini index (or some other measure of inequality) in country i at dates t=0,1,.., T. A test equation for inequality convergence is then:

---

5 Li et al. (1998) perform standard Durbin-Watson tests on their regressions for explaining inequality in a cross-country panel, and they also give estimates with a standard correction for first-order serial correlation in the error term. This would probably help avoid bias due to miss-specification of the dynamics in a time-series model. However, the D-W test and standard AR(1) correction are not valid in panel data. (One can change the results by shuffling the order of countries.)

6 Using the same method as Bénabou, Banerjee and Duflo (1999) also not (in passing) that their data suggest a negative linear relationship between changes in inequality and past inequality.

$$G_{iT} - G_{i0} = a + bG_{i0} + e_i \qquad (i=1,...,N) \tag{1}$$

where a and b are parameters to be estimated and e is a zero mean error term. If the "convergence parameter" b is negative (positive) then there is inequality convergence (divergence). For non-zero b, steady-state inequality converges to an expected value of $-a/b$.

One objection to this test is that measurement error in the observed inequality data will bias such a test in the direction of suggesting convergence, as discussed in the introduction. Another concern is that data are thrown away between the initial and final surveys. This also raises the question as to whether the changes between the first and last dates are independent of the path taken.

To address these concerns, let the true value of the Gini index be G^*_{it}. (These are date specific, since the fundamental determinants of inequality can change.) Each country is assumed to have an underlying trend, R_i, in inequality, such that the change in the true level of inequality between date 1 and any date t is:

$$G^*_{it} - G^*_{i1} = R_i(t-1) + \nu_{it} \qquad (i=1,...,N;\ t=2,..,T) \tag{2}$$

where ν_{it} is a zero-mean innovation error term. (Measured inequality at date 0 is now retained for use as an instrumental variable.) The observed measure of inequality is:

$$G_{it} = G^*_{it} + \varepsilon_{it} \tag{3}$$

where ε_{it} is a zero-mean and serially independent measurement error.

The hypothesis to be tested is that this trend in steady-state inequality depends on its initial level. I assume a linear relationship of the form:

$$R_i = \alpha + \beta G^*_{i1} + \mu_i \tag{4}$$

where α and β are parameters to be estimated and μ_i is a zero-mean innovation error term.

Combining equations (2)-(4), the estimable test equation can be written in the form:

$$G_{it} - G_{i1} = (\alpha + \beta G_{i1})(t-1) + e_{it} \quad (i=1,\ldots,N;\ t=2,..,T) \tag{5}$$

where the composite (heteroskedastic) error term is:

$$e_{it} \equiv v_{it} + \varepsilon_{it} - \varepsilon_{i1} + (t-1)(\mu_i - \beta\varepsilon_{i1}) . \tag{6}$$

Notice that ε_{i1} jointly influences G_{i1} and e_{it}. So it cannot be assumed that $\mathrm{cov}(G_{i0}t, e_{it}) = 0$. However, G_{i0} is a valid instrument for G_{i1}. The key assumption for this to hold is that the errors in measuring inequality are serially independent. That assumption can be questioned; the same factors that lead to miss-measurement of inequality in one survey for a given country may well carry over to the next survey. In principle one could allow for some serial dependence in measurement errors, such as a first-order moving average process, justifying use of a second lag. However, with so few observations over time, it is not feasible to relax the serial independence assumption for measurement errors in the inequality data.

The above test can be generalized to allow for short-term dynamics, such that the observed inequality index at any date is only partially adjusted to its long-run value. This complicates the estimation procedure somewhat, given the uneven spacing of the underlying survey data.

Given that it is not feasible to estimate country-specific autoregression coefficients with such short series, I impose the restriction that the coefficient is the same across the whole sample. This is the key identifying assumption used to make up for the shortage of time series observations for individual countries. In particular, equation (3) is replaced by:

$$G_{it} = \phi G_{it-1} + (1-\phi)G^*_{it} + \varepsilon_{it} \tag{7}$$

where ϕ is the common first-order autoregression coefficient ($-1 < \phi < 1$). Thus measured inequality will increase (decrease) in expectation whenever it is below (above) the true steady-state level. Notice that there is no constant term in (7); if the expected change in inequality is zero then inequality must be at its steady state value. (This can be taken as a defining characteristic of the steady state.)

With this change, it is now relevant that the data are not evenly spaced over time since surveys have diverse frequencies. Let τ_{it} denote the number of years since the last survey. On repeatedly using equation (7) to eliminate the Gini index for years in which there was no survey, one can re-write equation (7) in the following form (dropping the subscripts on τ_{it} to simplify the notation):

$$G_{it} = \phi^{\tau} G_{it-\tau} + (1-\phi)\sum_{j=0}^{\tau-1}\phi^{j} G^{*}_{it-j} + \upsilon_{it} \tag{8}$$

where

$$\upsilon_{it} \equiv \sum_{j=1}^{\tau}\phi^{j-1}\varepsilon^{j}_{it} \tag{9}$$

is the (heteroskedastic) error term. Substituting (2) into (7) and re-arranging we have:

$$G_{it} = \phi^{\tau} G_{it-\tau} + G^{*}_{i0}A_{it} + T_i[A_{it}t - B_{it}] + \upsilon_{it} \tag{10}$$

where

$$A_{it} \equiv (1-\phi)\sum_{j=0}^{\tau-1}\phi^{j} = 1-\phi^{\tau} \tag{11}$$

$$B_{it} \equiv (1-\phi)\sum_{j=0}^{\tau-1} j\phi^{j} = \frac{\phi(1-\phi^{\tau})}{1-\phi} - \tau_{it}\phi^{\tau} \tag{12}$$

on evaluating the two sums of arithmetic progressions in equations (8) and (9).

On taking the differences over time between surveys, and noting that:

$$G_{i0}^{*}A_{it} + T_iA_{it}t = (1-\varphi^{\tau})G_{it}^{*} \tag{13}$$

it is instructive to re-write (8) in the form:

$$\Delta_{\tau}G_{it} = (1-\phi^{\tau})(G_{it}^{*} - G_{it-\tau}) - T_iB_{it} + \upsilon_{it} \tag{14}$$

This shows how the observed change in inequality can be decomposed into three components. The first term on the right hand side of (14) is the effect of the deviation between the current survey's measured Gini index and the underlying steady-state value for that date. The second term arises from the uneven spacing, given the possible existence of a trend; notice that this term drops out if τ_{it}=1 for all i and t. Finally, there is a component due to the error term.

Equation (10) is a non-linear panel data model in which the parameters include the error-free steady-state Gini index (G_{i0}^{*}) at the common start date and the subsequent country-specific trend (T_i), allowing for (common) serial dependence and measurement errors. If survey spacing was even, with the same frequency for all countries (τ_{it}=1 for all i, t), then (10) would simply be a linear regression of the measure of inequality on its own lagged value, country-specific intercepts (giving $(1-\phi)G_{i0}^{*}$), and a time trend with country-specific coefficients (giving $(1-\phi)T_i$). The uneven spacing makes the regression intrinsically nonlinear in parameters.

4. Results

The convergence tests were done on two data sets. For the first, I chose all countries with four or more surveys in the Chen and Ravallion (2000) data set.[7] This gave 86 "spells" for 21 countries. The welfare indicators used in measuring inequality are a mixture of consumption

---

[7] For the latest version of the data set see http://www.worldbank.org/research/povmonitor/. This paper used the data set available mid-2000; see the Appendix for details.

expenditures and incomes surveys, though all are per capita distributions and are household-size weighted. About 80% of the surveys are in the 1990s. All Gini indices have been estimated from the primary data (micro data or consistent tabulations of points on the distribution) by consistent methods; in contrast to all other compilations I know of, no secondary sources have been used. The Appendix gives summary data on the time periods and number of surveys for each country. The second data set is that used by Li et al., (1998), drawing on Deininger and Squire (1996).

I found no evidence of short-run dynamics. Nonlinear least squares estimates of the augmented test equation based on (10) (after using equation (4) to eliminate the trends) gave estimates of ϕ that were not significantly different from zero. For the (linear) Gini index the estimate was 0.026 with a standard error of 0.251; for the log Gini index, the estimate was –0.010 with a standard error of 0.021. While the shortage of time series observations casts obvious doubt on how well the dynamics can be identified with these data and they are surely biased, it appears to be reasonable to assume that $\phi = 0$ in the rest of the analysis.

Table 1 gives both OLS and IVE estimates of equation (5). These are regressions of the change in the Gini index between each date and the second survey year on the Gini index for the latter. (Results are also given for the log of the Gini index.) Notice that 21 observations have to be dropped to form the instrument. For comparison purposes, the OLS estimate is for the same sample as the IVE estimate. I tried adding two dummy variables to the regressions, one for when the survey switched from income to expenditure (relative to the initial survey) and one when it switched from expenditure to income. However, there were only a few cases of such switches, and the extra dummy variables made negligible difference to the convergence results (coefficients and standard errors), so I dropped them.

There is a strong indication of convergence for both the linear and log specifications, and this is robust to allowing for measurement error, using initial inequality as the instrument for the second observation in the series. (The first stage regressions were significant at better than the 0.1% levels.) Indeed, the IVE and OLS estimates are very close, suggesting only a small bias due to measurement error.

The intercepts are low enough to generate convergence toward medium inequality. Consider two countries, one with a Gini index of 30%, one 60%. Taking the instrumental variables estimates for the (linear) Gini index to be preferred, the expected trend will be 0.31 per year in the first case and –0.57 in the second. In 15 years, the two countries would expect to reach Gini indices of 35% and 51%. The log specification gives a broadly similar result. The implied steady-state level of the Gini index is in the range 40-41% in all specifications.

Since there is little sign of bias in the OLS estimates in Table 1, and by not instrumenting for the first inequality observation one gains 21 observations, I now switch to OLS on the larger samples. Table 2 gives results for various sample choices. The results are quite similar if one excludes the countries in Eastern Europe and the former Soviet Union. The table also gives the results of the convergence test if one uses the full sample in the Chen-Ravallion data set, i.e., including countries with fewer than four surveys (but at least two). This increases the sample size considerably, with 155 observations for 66 countries. Again the convergence parameter is negative and very significant. This is again robust to dropping Eastern Europe.

Figure 1(a) plots the annualized change in the log Gini index against the initial value. Thus the vertical axis in Figure 1 can be interpreted as the proportionate change in the Gini index per year. Panel (b) of Figure 1 gives the corresponding results for the sample of 66 countries.

Convergence is also evident throughout the Lorenz curve. Table 3 gives the test results by fractile for the full sample, and excluding Eastern Europe. The Lorenz curve is converging to one in which the poorest quintile hold 5.8% of income (2.4% for the poorest decile), while the richest decile hold 33.7%. Figure 2 gives the analogous recursion diagram to Figure 1 for the shares of the poorest and richest deciles. The four countries whose initial shares are closest to those of the Lorenz curve that the countries as a whole are tending to converge toward are (in ascending order of the sum of squared deviations): Jamaica, Tunisia, Philippines and Ecuador.

Figure 3(a) plots the trend against the predicted initial level (in logs) for the 21 country sample. The country-specific trends were obtained by estimating the model without substituting out the trends (section 3), thus allowing estimation of country-specific initial steady-state values and trends. (While it is clearly more efficient to estimate (5) directly, it is of interest to see what the country-specific trends look like.)

I also tested for inequality convergence in the Deininger and Squire (1996) data set which also includes OECD countries.[8] This data set also goes back further in time allowing an average of 12 surveys per country, though with expected costs in terms of data quality, particularly for developing countries. Li et al. (1998) report the trend coefficients and intercepts for 49 countries of a static regression of the Gini index on time estimated on the Deininger and Squire data set (Li et al., 1998, Table 4). I chose the reference year to be 1965, the median of the country-specific start dates reported in Li et al. (1998, Table 2). On performing my convergence test on these data, the OLS estimate of β was –0.0113 with a White standard error of 0.0028; the estimate of

[8] The data sets overlap slightly. An earlier version of the Chen-Ravallion data set is one of the sources of the Deininger-Squire (1996) data set, though the latter data set uses many other sources as well. The main difference between the two data sets is that by going back to the raw data (or special-purpose tabulations constructed from that data), Chen and Ravallion are able to eliminate inconsistencies in the methods used by secondary sources.

α was 0.4242 with a standard error of 0.1065 (and R^2=0.267). Figure 3(b) plots the trends against the estimated 1965 level.

5. Conclusions

It has been argued in recent literature that (with few exceptions) within-country inequality is stable over time. The above results cast doubt on this claim. Evidence is found of inequality convergence, with a tendency for within-country inequality to fall (rise) in countries with initially high (low) inequality. There is a reasonably strong negative correlation between the initial Gini index and the subsequent change in the index, though this undoubtedly contaminated by measurement error. The effect is not as strong when one allows for measurement error by comparing estimated trends with predicted initial levels. But the correlation is still there and the speed of convergence is very similar.

The process of convergence toward medium inequality implied by these results is clearly not rapid, and (as always when generalizing from cross-country comparisons) it should not be forgotten that there are deviations from these trends, both over time and across countries. The shortage of comparable survey observations over time for many countries raises doubts about how well the trends have been estimated. This issue should be revisited when more (and probably better quality) data come on stream. This would permit more precise identification of any trends and weaker identification assumptions, notably by allowing for serial dependence in measurement errors. However, inequality convergence does appear to be a feature of the best data currently available. It seems that countries are tending to become more equally unequal, heading toward a Gini index of around 40%.

There are two clear directions for further work. The first is to better understand why we are seeing inequality convergence. The phenomenon is hardly surprising if one believes modern versions of the neoclassical growth model and one assumes that growth fundamentals do not differ in important ways; then the whole levels distribution should converge, not just its first moment. This is not a very satisfying explanation, given that fundamentals do seem to differ in important ways. However, what we may well be seeing is the interaction of an underlying neoclassical growth process with a process (albeit uncertain and slow) of convergence in fundamentals. Possibly convergence arises from the interaction of economic policy convergence with pre-reform differences between countries in the extent of inequality. Widespread transition to a more market-oriented economy may well attenuate extremes in within-country inequality, but reach bounds related to differences between countries in underlying asset distributions. This could well put a break on the (unconditional) convergence process we are seeing, although the emerging emphasis in policy discussions on achieving more pro-poor distributions of human and physical (including land) assets may well foster continuing convergence in fundamentals.

A deeper analysis of the sources of inequality convergence could well have implications for other explanatory variables relevant to understanding the evolution of inequality. That points to a second direction for further work, namely to test richer causal models. The present paper has offered an approach to modeling the determinants of inequality. Only a simple specification has been estimated here, as required to test for (unconditional) convergence. However, the approach appears to offer a starting point for estimating richer models.

References

Banerjee, Abhijit and Esther Duflo (1999), "Inequality and Growth: What Can the Data Say?" mimeo, Department of Economics, MIT.

Bénabou, Roland (1996), "Inequality and Growth", in Ben Bernanke and Julio Rotemberg (eds) *National Bureau of Economic Research Macroeconomics Annual*, Cambridge: MIT Press, pp.11-74.

Bruno, Michael, Martin Ravallion and Lyn Squire (1998), "Equity and growth in developing countries: Old and new perspectives on the policy issues," in *Income Distribution and High-Quality Growth* (edited by Vito Tanzi and Ke-young Chu), Cambridge, Mass: MIT Press.

Chen, Shaohua and Martin Ravallion (2000), "How did the world's poorest fare in the 1990s?" Policy Research Working Paper, World Bank, Washington DC.

Davidson, Russell and James G. MacKinnon (1993), *Estimation and Inference in Econometrics*, New York: Oxford University Press.

Deininger, Klaus and Lyn Squire (1996), "A new data set measuring income inequality", *World Bank Economic Review* 10: 565-592.

Dollar, David and Aart Kraay (2000), "Growth *is* good for the poor", mimeo, Development Research Group, World Bank, Washington DC.

Durlauf, Steven N., and Danny T. Quah (1999), "The new empirics of economic growth", *Handbook of Macroeconomics,* Amsterdam: North-Holland.

Kraay, Aart and Martin Ravallion (2001), "Distributional impacts of aggregate growth when individual incomes are measured with error," mimeo, Development Research Group, World Bank.

Li, Hongyi, Lyn Squire and Heng-fu Zou, 1998, "Explaining international and intertemporal variations in income inequality", *Economic Journal* 108: 26-43.

Milanovic, Branko, (1998), *Income, Inequality and Poverty during the Transition from Planned to Market Economy*, Washington DC: World Bank.

__________, (2001), "True world income distribution: 1988 and 1993: First calculations based on household surveys alone," *Economic Journal*, forthcoming.

Ravallion, Martin, (2001), "Growth, Poverty and Inequality: Looking beyond Averages," *World Development*, forthcoming.

Ravallion, Martin and Shaohua Chen, 1997, "What Can New Survey Data Tell Us about Recent Changes in Distribution and Poverty?," *World Bank Economic Review*, 11(2): 357-82.

____________, and ___________, 1999, "When Economic Reform is Faster than Statistical Reform: Measuring and Explaining Inequality in Rural China", *Oxford Bulletin of Economics and Statistics*, 61: 33-56.

World Bank, 2000, *World Development Indicators*, Washington DC: World Bank.

Table 1: Tests for Inequality Convergence

		Intercept (α)	Slope (β)	N	R^2
Gini index	OLS	1.1527	-0.0284	65	0.1571
		(0.2852)	(0.0070)		
	IVE	1.1791	-0.0291	65	0.1570
		(0.3552)	(0.0089)		
Log Gini index	OLS	0.1012	-0.0274	65	0.1647
		(0.0372)	(0.0094)		
	IVE	0.1076	-0.0290	65	0.1391
		(0.0383)	(0.0103)		

Note: Standard errors in parentheses; the heteroskedasticity-consistent covariance matrix estimator is used (HC1). IVE columns use the initial value as the instrument for the inequality measure in the second survey.

Table 2: Tests for Convergence on Various Samples

	Intercept		Slope		N	R^2
	Coefficient	s.e.	Coefficient	s.e.		
Gini						
21 country sample	1.1458	0.2246	-0.0329	0.0054	86	0.3449
Minus Eastern Europe	1.3392	0.2349	-0.0304	0.0054	74	0.3042
66 country sample	2.0843	0.2511	-0.0460	0.0058	155	0.2827
Minus Eastern Europe	1.3907	0.2312	-0.0311	0.0054	117	0.1715
Log Gini						
21 country sample	0.1446	0.0209	-0.0382	0.0056	86	0.3963
Minus Eastern Europe	0.1234	0.0204	-0.0326	0.0054	74	0.3339
66 country sample	0.2090	0.0238	-0.0551	0.0064	155	0.3505
Minus Eastern Europe	0.1245	0.0185	-0.0329	0.0049	117	0.1800

Note: The dependent variable is the change in the Gini index relative to the first survey (log Gini index in the lower panel). The heteroskedasticity-consistent covariance matrix estimator is used (HC1).

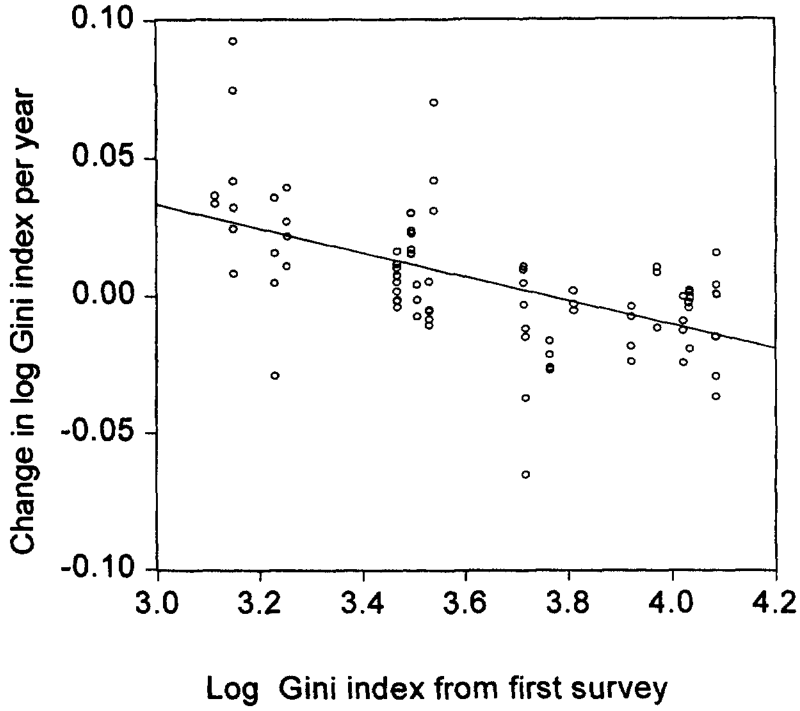
Table 3: Tests for Lorenz Curve Convergence

	Intercept		Slope		N	R^2
	Coefficient	s.e.	Coefficient	s.e.		
Share of poorest decile	0.1288	0.0169	-0.0538	0.0072	155	0.2941
Minus Eastern Europe	0.0766	0.0152	-0.0240	0.0056	117	0.0956
Share of decile 2	0.1720	0.0208	-0.0505	0.0061	155	0.3228
Minus Eastern Europe	0.1115	0.0186	-0.0282	0.0049	117	0.1477
Share of middle (3-8)	2.8299	0.3290	-0.0627	0.0070	155	0.3830
Minus Eastern Europe	2.8137	0.3932	-0.0624	0.0086	117	0.3423
Share of decile 9	0.8544	0.1557	-0.0559	0.0101	155	0.2140
Minus Eastern Europe	0.7164	0.2033	-0.0475	0.0130	117	0.1613
Share of richest decile	2.1507	0.2303	-0.0638	0.0071	155	0.3902
Minus Eastern Europe	2.0204	0.2963	-0.0605	0.0088	117	0.3217

Note: The dependent variable is the change in the Lorenz share relative to the first survey. The heteroskedasticity-consistent covariance matrix estimator is used (HC1).

Figure 1: Inequality convergence

(a) 21 countries



(b) 66 countries

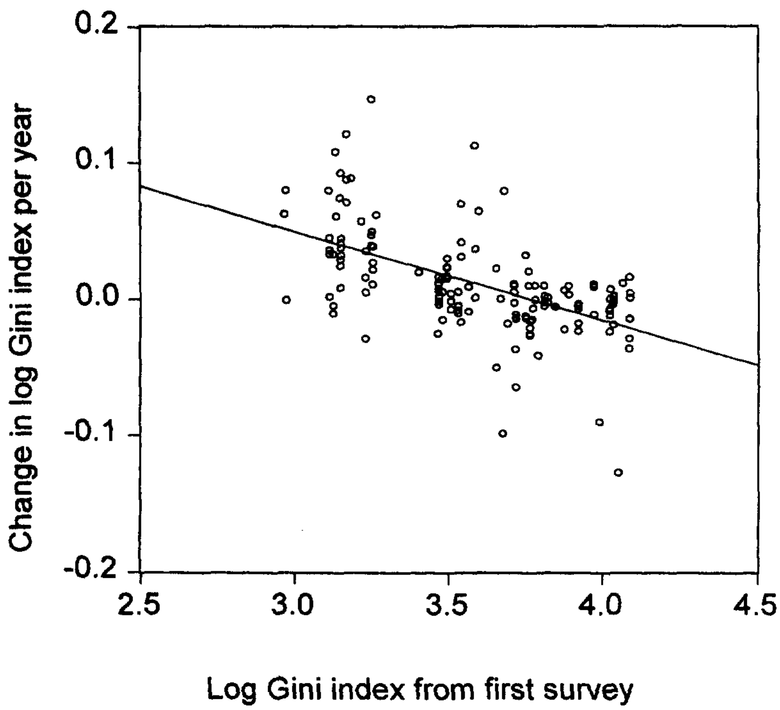
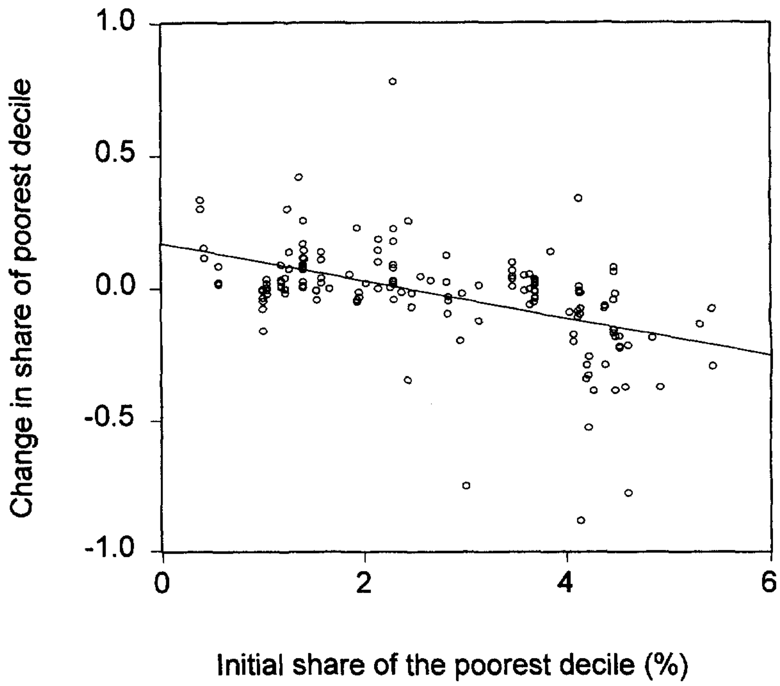


Figure 2: Lorenz share convergence for the poor and the rich

(a) Poorest decile



(b) Richest decile

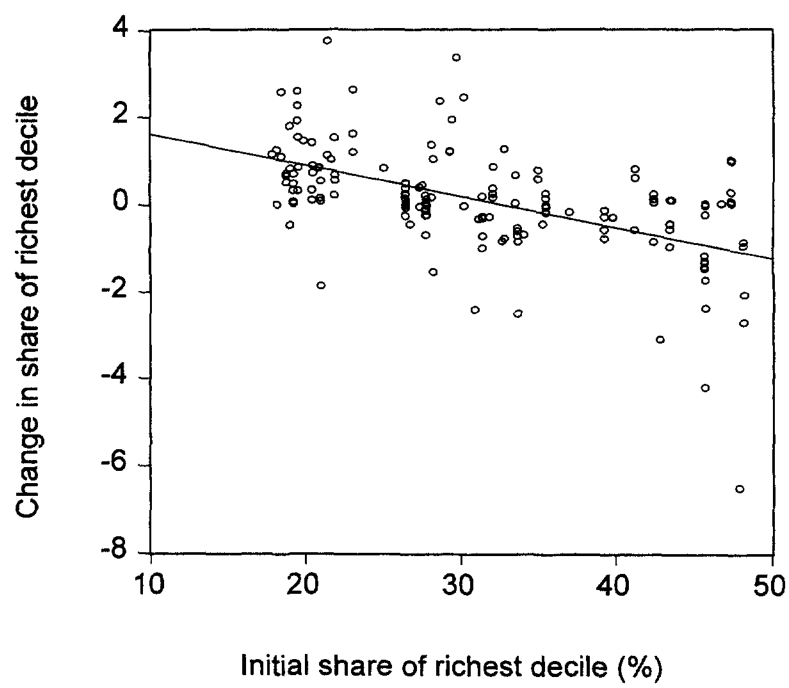
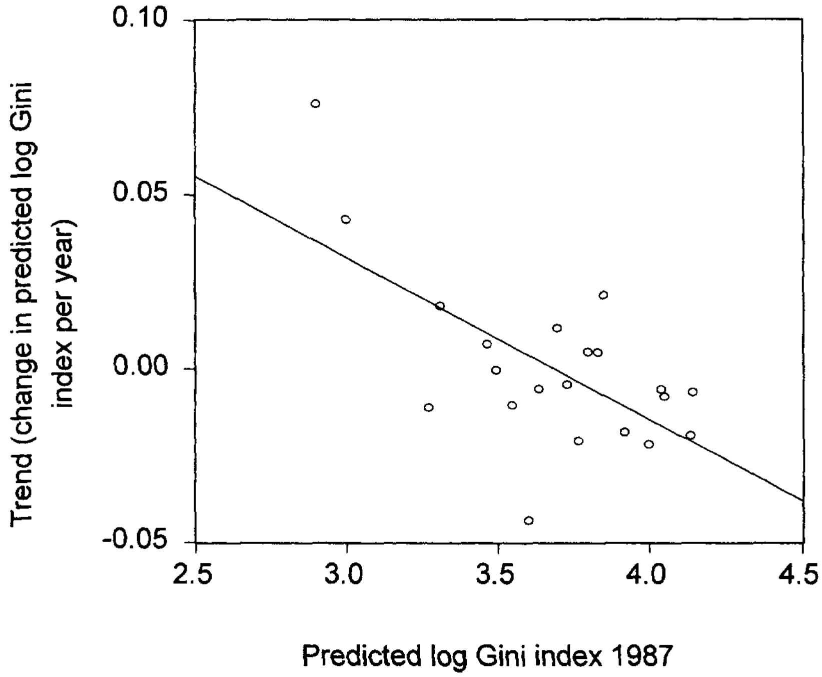
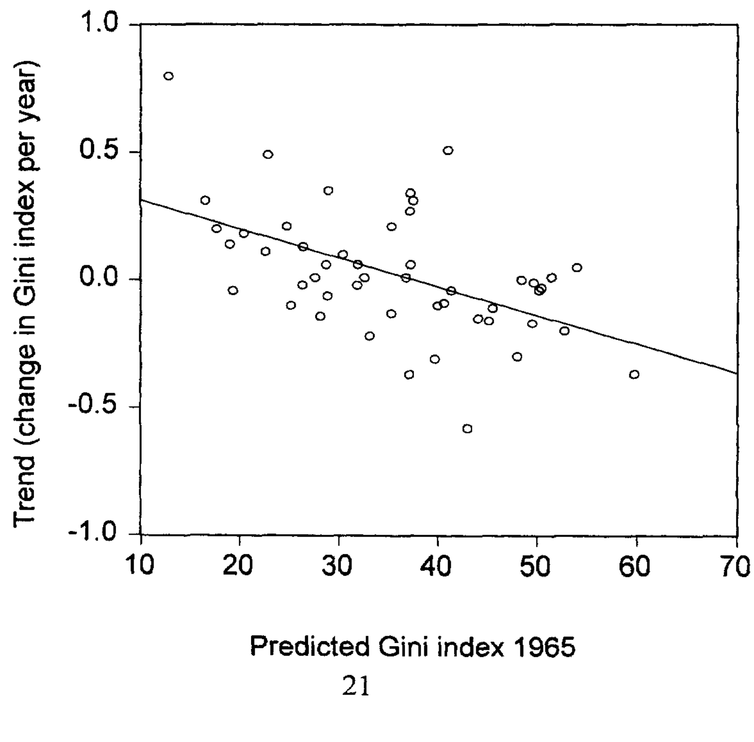


Figure 3: Steady state convergence tests

(a) 21 countries (Chen-Ravallion)



(b) 47 countries (Deininger-Squire)



Appendix: Countries with more than one survey in the Chen-Ravallion data set

Region	Country	Survey dates	Welfare indicator (per person)
East Asia	China	1985, 1990, 1992-98	Income
	Indonesia	1984, 1987, 1990, 1993, 1996, 1999	Expenditure
	Korea	1988, 1993	Income
	Malaysia	1984, 1987, 1992, 1995	Income
	Philippines	1985, 1988, 1991, 1994, 1997	Expenditure
	Thailand	1981, 1988	Income
		1988, 1992, 1996, 1998	Expenditure
Eastern Europe and Central Asia	Belarus	1988, 1993, 1995, 1998	Income
	Bulgaria	1989, 1992, 1994, 1995	Expenditure
	Czech Republic	1988, 1993	Income
	Estonia	1988, 1993, 1995	Income
	Hungary	1989, 1993	Income
	Kazakhstan	1988, 1993	Income
		1993, 1996	Expenditure
	Kyrgyz Republic	1988, 1993	Income
		1993, 1997	Expenditure
	Latvia	1988, 1993, 1995, 1998	Income
	Lithuania	1988, 1993, 1994, 1996	Income
	Moldova	1988, 1992	Income
	Poland	1985, 1987, 1989, 1993	Income
		1990, 1992, 1993-96	Expenditure
	Romania	1989, 1992, 1994	Income
	Russian Federation	1988, 1993	Income
		1993, 1996, 1998	Expenditure
	Slovak Republic	1988, 1992	Income
	Slovenia	1987, 1993	Income
	Turkey	1987, 1994	Expenditure
	Turkmenistan	1988, 1993	Income
	Ukraine	1988, 1992	Income
		1995, 1996	Expenditure
	Uzbekistan	1988, 1993	Income
Latin America & Caribbean	Brazil	1985, 1988-89, 1993, 1995-96	Income
	Chile	1987, 1990, 1992, 1994	Income
	Colombia	1988, 1991, 1995-96	Income
	Costa Rica	1986, 1990, 1993, 1996	Income
	Dominican Rep.	1989, 1996	Income
	Ecuador	1988, 1994-95	Expenditure
	El Salvador	1989, 1995-96	Income
	Guatemala	1987, 1989	Income

	Honduras	1989-90, 1992, 1994, 1996	Income
	Jamaica	1988-90, 1993, 1996	Expenditure
	México	1984, 1992	Expenditure
		1989, 1995	Income
	Panama	1989, 1991, 1995-97	Income
	Paraguay	1990, 1995	Income
	Peru	1985, 1994, 1996	Expenditure
		1994, 1996	Income
	Trinidad & Tobago	1988, 1992	Income
	Venezuela	1981, 1987, 1989, 1993, 1995-96	Income
Middle East and North Africa	Algeria	1988, 1995	Expenditure
	Egypt	1991, 1995	Expenditure
	Jordan	1987, 1992, 1997	Expenditure
	Morocco	1985, 1990	Expenditure
	Tunisia	1985, 1990	Expenditure
	Yemen	1992, 1998	Expenditure
South Asia	Bangladesh	1984-85, 1988, 1992, 1996	Expenditure
	India	1983, 1986-90, 1992, 1994-97	Expenditure
	Nepal	1985, 1995	Expenditure
	Pakistan	1986/7, 1990/1, 1992/3, 1996/7	Expenditure
	Sri Lanka	1985, 1990, 1995	Expenditure
Sub-Saharan Africa	Cote d'Ivoire	1985-88, 1993, 1995	Expenditure
	Ethiopia	1981, 1995	Expenditure
	Ghana	1987, 1989	Expenditure
	Kenya	1992, 1994	Expenditure
	Lesotho	1986, 1993	Expenditure
	Madagascar	1980, 1993, 1997	Expenditure
	Mali	1989, 1994	Expenditure
	Mauritania	1988, 1993, 1995	Expenditure
	Niger	1992, 1995	Expenditure
	Nigeria	1985, 1992, 1997	Expenditure
	Senegal	1991, 1994	Expenditure
	Uganda	1988, 1992	Expenditure
	Zambia	1991, 1993, 1996	Expenditure

Note: This only includes countries with more than one survey; for full details see Chen and Ravallion (2000).

Policy Research Working Paper Series

	Title	Author	Date	Contact for paper
WPS2628	Monopoly Power and Distribution in Fragmented Markets: The Case of Groundwater	Hanan G. Jacoby Rinku Murgai Saeed Ur Rehman	June 2001	P. Kokila 33716
WPS2629	Bridging the Digital Divide: How Enterprise Ownership and Foreign Competition Affect Internet Access in Eastern Europe and Central Asia	George R. G. Clarke	July 2001	P. Sintim-Aboagye 37644
WPS2630	Parallel Imports of Pharmaceutical Products in the European Union	Mattias Ganslandt	July 2001	L. Tabada 36896
WPS2631	Pension Reform in Hungary: A Preliminary Assessment	Roberta Rocha Dimitri Vittas	July 2001	L. Gross 37030
WPS2632	Human Capital and Growth: The Recovered Role of Education Systems	Sébastien Dessus	July 2001	K. Mazo 39744
WPS2633	Bank Privatization in Argentina: A Model of Political Constraints and Differential Outcomes	George R. G. Clarke Robert Cull	July 2001	P. Sintim-Aboagye 37644
WPS2634	Chile's Regional Arrangements and the Free Trade Agreement of the Americas: The Importance of Market Access	Glenn W. Harrison Thomas F. Rutherford David G. Tarr	July 2001	L. Tabada 36896
WPS2635	Optimal Use of Carbon Sequestration in a Global Climate Change Strategy: Is There a Wooden Bridge to a Clean Energy Future?	Franck Lecocq Kenneth Chomitz	July 2001	V. Soukhanov 35721
WPS2636	Processes, Information, and Accounting Gaps in the Regulation of Argentina's Private Railways	Javier Campos-Méndez Antonio Estache Lourdes Trujillo	July 2001	G. Chenet-Smith 36370
WPS2637	Technical Efficiency Gains from Port Reform: The Potential for Yardstick Competition in Mexico	Antonio Estache Marianela González Lourdes Trujillo	July 2001	G. Chenet-Smith 36370
WPS2638	On Financing Global and International Public Goods	Todd Sandler	July 2001	S. Kpundeh
WPS2639	Public Policy toward Nongovernmental Organizations in Developing Countries	William Jack	July 2001	H. Sladovich 37698
WPS2640	Where Has All the Foreign Investment Gone in Russia?	Harry G. Broadman Francesca Recanatini	July 2001	S. Craig 33160

Policy Research Working Paper Series

	Title	Author	Date	Contact for paper
WPS2641	Is Russia Restructuring? New Evidence on Job Creation and Destruction	Harry G. Broadman Francesca Recanatini	July 2001	S. Craig 33160
WPS2642	Does the Exchange Rate Regime Affect Macroeconomic Performance? Evidence from Transition Economies	Ilker Domaç Kyles Peters Yevgeny Yuzefovich	July 2001	A. Carcani 30241
WPS2643	Dollarization and Semi-Dollarization in Ecuador	Paul Beckerman	July 2001	P. Holt 37707
WPS2644	Local Institutions, Poverty, and Household Welfare in Bolivia	Christiaan Grootaert Deepa Narayan	July 2001	G. Ochieng 31123

8\3